THE INFLUENCE OF GROUND-WATER-LEVEL DECLINES ON STREAMFLOW IN THE OKLAHOMA PANHANDLE--AN UPDATE

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ABSTRACT

Increased withdrawal from the High Plains aquifer has resulted in widespread water-level declines in the aquifer. Declines of 25 to 50 feet are common in Cimarron, Texas, and Beaver Counties, which comprise the Panhandle of western Oklahoma. South of Guymon in Texas County, water levels have declined about 100 feet. The number of large-capacity wells (primarily irrigation wells) in the Panhandle increased from about 450 to about 2,500 between 1963 and 1984; the rate of increase was greatest between 1963 and 1975.

The Beaver River (headwaters of the North Canadian River) drains most of the Oklahoma Panhandle and has been gaged near Guymon since October 1937. Trend tests reported by the authors in a 1988 paper confirm that the discharge of the river has decreased substantially since the mid-1960's. There have been no corresponding changes in annual precipitation, and changes in the use of surface water have been minimal during this period. Average annual discharge at Guymon for the 23-year period 1938-60 was 32.2 cubic feet per second (23,310 acre-feet); the average annual discharge for the last 10 years (1983-92) has been 0.80 cubic foot per second (580 acre-feet). Prior to the mid-1960's, the river at Guymon was generally perennial; flow ceased only during droughts and then never for more than 60 days in any given year. Since 1968, the river at Guymon has been dry for extended periods every year. During the last ten years (1983-92), the river has been dry for an average of more than 300 days per year.

The influence of cropland terracing and stockpond construction on streamflows is uncertain, but neither factor is thought to have played a significant role in reducing streamflows. Less than 1 percent of the cropland acreage of Texas and Cimarron Counties had been terraced by 1987. The number of stock ponds in the region did increase about ten-fold between 1940 and 1985, but the rate of increase was greatest before 1960. Any effects of stock ponds on streamflows would have been gradual and should have been reflected in discharges before the mid-1960's.

The reductions in streamflow have affected Optima Reservoir, located in Texas County on the Beaver River just downstream from Coldwater Creek. Construction of Optima Dam began in 1966; thus, all data available for planning and design predated the decreases in streamflow. Storage began in October 1978 after streamflow had begun to decrease. The maximum storage in the reservoir to this time (1993) has been 7,610 acre-ft, only about 6 percent of the capacity of the conservation pool.

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